EXECUTIVE SUMMARY

An ecological risk assessment (ERA) was conducted for the Midnite Mine site on the Spokane Indian Reservation in Stevens County, Washington. Midnite Mine is an inactive open pit uranium mine that was added to the National Priorities List (NPL) in May 2000. Mining of the ore by the Dawn Mining Company (DMC) between 1955 and 1981 resulted in the releases of metals and radionuclides.

The site is defined by the mined area (MA) and the potentially impacted area (PIA). The MA presents a dominant impact to the ecosystems as a visibly disturbed area of approximately 343 acres providing limited and poor quality habitat for wildlife. The MA is characterized as a rocky landscape with limited vegetation. The MA contains five lacustrine habitats designated as Pit 3, Pit 4, Blood Pool, Pollution Control Pond (PCP), and the Outfall Pond. Each of these lacustrine habitats are artificial formations evolved from the mining operations and are contaminated with metals and radionuclides. Pit 3 and the PCP have the highest concentrations of contaminants. The MA is an attraction to wildlife for watering and presumably consumption of mineral salts deposited around the lacustrine habitats. A number of animals (e.g., deer, elk, moose, coyote, bear, and turkey) have been sighted within the MA. In addition, some animals (e.g., marmots and cliff swallows) have been observed to reside within the MA for more extensive periods of time.

The PIA encompasses areas adjacent or near the MA including upland areas that may have been affected by the mining activities, two haul roads (East and West Haul Roads) that run through the PIA to the MA, and downstream drainages that flow into Blue Creek. The upland PIA is largely undisturbed by mining activities and is dominated by an overstory of either ponderosa pine or a mixture of ponderosa pine and Douglas fir trees. The two haul roads (East and West Haul Roads) running through the PIA are unpaved roads that were surfaced with gravel and waste rock originating from the MA. In addition, material lost from haul trucks along with dust and runoff from the roads may have affected areas adjacent to the roads.

Runoff from the MA enters seven drainages: Western, Central, Eastern, Northeastern, Northern, Far Western, and Southwestern Drainages. The Eastern Drainage receives flow from the Northeastern Drainage and, south of the site, from the Western and Central Drainages before entering Blue Creek. The flow conditions of these drainages from late fall to spring is essentially based on mine drainage, seasonal precipitation, and snow melt. A seep collection system that operates year round back-pumps the seepages collected from the Eastern, Central and Western Drainages to Pit 3 in the MA. From spring to fall, the onsite water treatment facility (WTF) dewaters Pit 3 and Pit 4 and treats the water for metals removal before discharging to the Eastern Drainage. Discharge from this WTF, which is regulated under a federal discharge permit, can contribute greater than 95 percent (%) of the flow to the Eastern Drainage. Higher risks would be anticipated if the implementation of runoff controls, seep collection, and water treatment were not reducing the overall loading of site contaminants to AOIs within the PIA.

This ERA follows the Environmental Protection Agency (EPA) guidance of the Superfund Program (U.S. EPA 1997) for assessing risk from metal contamination and the United States Department of Energy (U.S. DOE) guidance (U.S. DOE 2002) for evaluating the risk from total ionizing radiation (TIR) to aquatic, riparian, and terrestrial biota. This ERA report encompasses a screening level ecological risk assessment (SLERA) and the baseline ecological risk assessment (BERA).

The SLERA , detailed in Section 2, retained contaminants of potential concern (COPC) for the BERA in surface water, instream sediments, riparian sediments, and soils based on conservative benchmark (BM) values and maximum metal concentrations measured at each area of interest (AOI) within the MA and PIA. Total ionizing radiation (TIR), screened based on the maximum exposures of the mine-related radionuclides, indicated that: the recommended USDOE dose criterion of 1.0 rad/day was exceeded for the protection of aquatic animals in the MA and PIA; the recommended USDOE dose criterion of 0.1 rad/day was exceeded for the protection of riparian animals in the PIA; the recommended USDOE dose criterion of 0.1 rad/day was exceeded for the protection of terrestrial animals in the MA and PIA; and the recommended USDOE dose criterion of 1.0 rad/day was exceeded for the protection of terrestrial plants in the MA.

The BERA, presented in Sections 3 to 9, begins with the problem formulation followed by the analysis and risk characterization phases. The problem formulation identified 22 assessment endpoints encompassing the aquatic, riparian, and terrestrial ecosystems within the MA and PIA to be characterized for risk from mine-related metals and radionuclides.

Assessment Endpoint #1: Viability and function of the periphyton community.
Assessment Endpoint #2: Viability and function of the benthic macroinvertebrate community.
Assessment Endpoint #3: Viability and function of the fish community
Assessment Endpoint #4: Viability and function of the terrestrial soil community.
Assessment Endpoint #5: Viability and function of the terrestrial plant community.
Assessment Endpoint #6: Viability and function of the herbivorous mammal community.
Assessment Endpoint #7: Viability and function of the carnivorous mammal community.
Assessment Endpoint #8: Viability and function of the omnivorous mammal community.
Assessment Endpoint #9: Viability and function of the piscivorous mammal community.
Assessment Endpoint #10: Viability and function of the soil invertebrate feeding mammal community.
Assessment Endpoint #11: Viability and function of the insectivorous avian community.
Assessment Endpoint #12: Viability and function of the omnivorous avian community.
Assessment Endpoint #13: Viability and function of the soil invertebrate feeding avian community.
Assessment Endpoint #14: Viability and function of the carnivorous avian community
Assessment Endpoint #15: Viability and function of the piscivorous avian community.
Assessment Endpoint #16: Viability and function of the herbivorous avian community
Assessment Endpoint #17: Viability and function of the amphibian community
Assessment Endpoint #18: Viability and function of the wetland plant community
Assessment Endpoint #19: Viability and function of the wetland invertebrate community
Assessment Endpoint #20: Observable Reductions of Survival and Reproductive Capability in Aquatic Animal Populations Related to Total Ionizing Radiation Exposure.

Assessment Endpoint #21: Observable Reductions of Survival and Reproductive Capability in Riparian Animal Populations Related to Total Ionizing Radiation Exposure.

Assessment Endpoint #22: Observable Reductions of Survival and Productivity and/or Reproductive Capability in Terrestrial Plant and Animal Populations Related to Total Ionizing Radiation Exposure.

Assessment Endpoints 1, 2, and 3 served to characterize risk of metal contamination to the aquatic ecosystems in the MA and PIA. Terrestrial ecosystems within the MA and PIA were characterized for risk based on assessment endpoints 4 through 16. Assessment Endpoints 4 and 5 served to characterize risk to the soil microorganisms and plant communities while Assessment Endpoints 6 through 16 served to characterize risk to the mammalian and avian communities. Assessment Endpoints 6 through 16, incorporating aquatic, riparian, and the terrestrial ecosystems within the project area, were evaluated through the use of food chain models. Four exposure models were used for each avian and/or mammalian receptor species to estimate exposure between abiotic exposure (i.e., surface water, sediments, or soils) and total exposure (i.e., abiotic exposure plus dietary component).

Three assessment endpoints served to characterize risk to the riparian/ wetland habitats within the PIA. Assessment Endpoint 17 served to identify risk to the amphibian community and Assessment Endpoints 18 and 19 served to characterize the risk to wetland plant and invertebrate communities. Three assessment endpoints (20, 21, and 22) were identified for characterizing risk from TIR. Risk to each of these assessment endpoints followed the same procedures as the SLERA with the exception that the central tendency concentrations of the site-related isotopes were used for calculating TIR exposure instead of the maximum concentrations. A summary of risk to each of these ecosystems - aquatic, terrestrial, and riparian/wetland - follows:

Aquatic Ecosystems

Risk was based exclusively on conservative screening-level BM values and maximum concentrations of metals in surface water and sediments and concluded that the aquatic communities, encompassing the periphyton, benthic macroinvertebrate, and fish communities, are at risk in the MA and PIA.

The lacustrine habitats within the MA presented a higher number of COPCs exceeding the BM values than the AOIs within the PIA. In addition, the hazard quotients (HQ) for several of the COPCs, particularly for aluminum (Al), beryllium (Be), cadmium (Cd), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), nickel (Ni), silver (Ag), selenium (Se), uranium (U), and zinc (Zn), tended to be one to two orders of magnitude higher within the AOIs of the MA than the PIA. The PCP and Pit 3 ranked the highest as contaminated habitats within the MA based on having a higher number of COPCs present and the most elevated HQs.

The drainages within the PIA tended to have a higher number of COPCs than the AOIs within Blue Creek. The predominant COPCs in the drainages and Middle Blue Creek included Al, barium (Ba), Be, Cd, Co, Cu, Pb, Mn, Ni, Se, U, and Zn. Upper Blue Creek and Lower Blue Creek had the least number of COPCs present.

Risk to the aquatic ecosystems was based primarily on screening level BM values along with some supporting evidence from site-specific studies conducted in March 2003. Regardless of the poor water quality conditions (low pH, high sulfate, high hardness) in the lacustrine habitats in the MA, the high metals concentrations in surface water and sediment pose substantial risk. The PIA drainages are also characterized by poor water quality; additionally several drainages flow intermittently or have low-flow conditions that could impact the aquatic community. However, the wide range and magnitude of COPCs in the PIA drainages pose risk to the aquatic communities independent of the other factors.

Terrestrial Ecosystems

Modeling risk to the terrestrial ecosystems integrated aquatic, riparian/wetland, and terrestrial systems. The terrestrial systems incorporated the MA and four AOIs within the PIA including the Northeast PIA, Southwest PIA, East Haul Road, and West Haul Road. The aquatic systems incorporated the sediment and surface water exposures for the aquatic habitats within the MA and PIA while the riparian/wetland systems incorporated six riparian AOIs within the PIA.

Terrestrial Soil Community

Risk to the terrestrial soil community was based exclusively on surface and subsurface soil concentrations exceeding conservative BM values. Chromium (Cr), Mn, U, vanadium (V), and Zn in surface soils exceeded the BM values at all AOIs within the MA and PIA. Arsenic (As), Co, Cu, molybdenum (Mo), and Ni also exceeded BM values at some locations. Four COPCs - Cd, Pb, Se, and thallium (Tl) - exceeded the BM values only at the MA.

Subsurface soil Cr, Mn, U, and V exceeded BM values at all AOIs in the PIA. Arsenic exceeded its BM at some locations. Molybdenum and Zn exceeded BM values at only the East Haul Road.

Terrestrial Plant Community

Risk to the terrestrial plant community was based exclusively on surface and subsurface soil concentrations exceeding screening level BM values for plants. Chromium, Mn, U, V, and Zn exceeded plant BM values at all of the AOIs within the MA and PIA. Arsenic, Co, Mo, and Ni exceeded the plant BM values at some locations. Cadmium, Pb, Se, and Tl exceeded the plant BMs only at the MA.

Subsurface soil Cr, U, and V exceeded the plant BM values at all of the AOIs in the PIA. Arsenic, Mn, and Zn exceeded the plant BM values at some locations. Molybdenum exceeded the plant BM only at East Haul Road.

Herbivorous Mammal Community

Three receptors - white tailed deer, meadow vole, and muskrat - were used for modeling dietary exposure risk to the herbivorous mammal communities utilizing the terrestrial, aquatic, and riparian areas at this site. When white-tailed deer was modeled, risk was driven by surface water and incidental soil ingestion. When

meadow voles or muskrat were modeled, risk was driven by metals in plant tissue. There was model-calculated risk to the herbivorous mammal communities from abiotic exposure to Se, U, and V in the MA; U in the West Haul Road and the Central Drainage; and U in the Central Drainage riparian area. There was model-calculated risk to the herbivorous mammal communities from total exposure to Mn and U at each AOI within the MA and PIA.

There was model-calculated possible risk to the herbivorous mammals for most of the remaining COPCs within the MA and PIA, primarily driven by the dietary component.

Carnivorous Mammal Community

The coyote and bobcat were used for modeling dietary exposure risk to the carnivorous mammal communities utilizing the terrestrial areas within the MA and PIA at this site. Risk was driven by the dietary component which was based on maximum literature-derived bioaccumulation factor (BAF) values for small mammals. There was model-calculated risk to the carnivorous mammals from total exposure to Cd, Mo, Se, U, and Zn in the MA and from exposure to Cd and U in the East and West Haul Roads.

Possible risk to carnivorous mammals may exist from abiotic exposure to Se, U, and V in the MA and U in the West Haul Road. Risk may also exist to the carnivorous mammals from total exposure to Pb and V in the MA, and from exposure to Cd, Se, Mo, U, and Zn within the PIA depending on location.

Omnivorous Mammal Community

The deer mouse and raccoon were used for modeling risk to the omnivorous mammal communities utilizing the terrestrial and aquatic areas within the MA and PIA at this site. When the deer mouse was modeled for the terrestrial areas, risk to the omnivorous mammal community was driven by the metals concentrations in soil and surface water including As, Mn, Mo, Se, and V in the MA; As, U, and V in the Haul Roads; and V in the Northeast PIA and Southwest PIA.

When the raccoon was modeled for the aquatic areas, risk to the omnivorous mammal community was primarily driven by abiotic exposure of U in the MA and by total exposure of Mn and U at several AOIs within the PIA.

Risk to the omnivorous mammal community may exist from V in the MA and from Ba, Cd, Se, and V at the AOIs within the PIA.

Piscivorous Mammal Community

The mink was used for modeling dietary exposure risk to the piscivorous mammal communities utilizing the aquatic systems within the MA and PIA. Risk was primarily driven by the dietary component which was based on maximum literature-derived BAF for fish. Risk to the piscivorous community in the MA was driven by predicted Cd, Ni, and U in fish particularly at Pit 3, PCP, and the Blood Pool. In the PIA the piscivorous mammal community was at risk from predicted Cd, Ni, and U in fish at the Central Drainage and U in fish at the Upper Eastern Drainage. Risk to the piscivorous mammal community was also driven by abiotic

exposure of U at the PCP in the MA and at the Central Drainage in the PIA. Risk from total exposure to U may exist at upper, middle and lower Blue Creek AOIs.

Soil Invertebrate Feeding Mammal Community

The masked shrew was used for modeling risk to the soil invertebrate feeding mammal communities utilizing the terrestrial systems within the MA and PIA. Model-calculated risk to the soil invertebrate feeding mammal community was determined from abiotic exposure to As, Mn, Mo, Se, U, and V in the MA; and to As, U, and V in the East Haul Roads; U and V in the West Haul Road; and to V at the Northeast PIA and Southwest PIA. When the dietary component incorporating the maximum BAF values for earthworms was applied in the modeling, risk was predicted from most of the COPCs.

Insectivorous Avian Community

The cliff swallow was used for modeling dietary exposure risk to the insectivorous avian communities utilizing the terrestrial systems within the MA and PIA. Abiotic exposure of soil and surface water did not pose risk to the insectivorous avian community. There was model-calculated risk to insectivorous birds from total exposure to Cu at the AOIs within the MA and PIA. Risk from exposure of Cd, Cr, Pb, and Zn in the dietary component may exist within the MA and each of the AOIs within the PIA, plus Se may impose risk within the MA.

Omnivorous Avian Community

The song sparrow and mallard duck were used for modeling dietary exposure risk to the omnivorous avian communities utilizing the terrestrial and aquatic areas within the MA and PIA. When the song sparrow was modeled for the terrestrial areas, risk to the omnivorous avian community was predicted for Se in the MA. When the mallard was modeled for the aquatic areas, risk to the omnivorous avian community was predicted from Cu at the PCP within the MA and from Se in the Lower Eastern Drainage.

Risk to the omnivorous avian community at the terrestrial systems may exist from abiotic exposure of Cr in the MA and from total exposure of Zn at all terrestrial AOIs in the MA and PIA when the song sparrow was used for the modeling. Risk to omnivorous birds for the aquatic systems may exist from As, Cd, Ni, U and Zn, primarily at the PCP within the MA and As, Cd, Mn, Se, U, and Zn at various AOIs within the PIA.

Soil Invertebrate Feeding Avian Community

The American robin and the Wilson's snipe were used for modeling dietary exposure risk to the soil invertebrate feeding avian communities utilizing the terrestrial, aquatic, and riparian areas at this site. When the American robin was modeled for the terrestrial areas, risk from abiotic exposure to the soil invertebrate feeding avian community was determined for Se in the MA. When the dietary component using maximum earthworm BAF values for the American robin was applied, risk to the soil invertebrate feeding birds was driven by predicted COPC concentrations for As, Cd, Cr, Cu, Pb, Se, and Zn in the MA and PIA.

When the Wilson's snipe for the aquatic and riparian areas, risk from abiotic exposure to the soil invertebrate feeding avian community was determined for Cu and Ni in the PCP within the MA and Se at the Lower Eastern Drainage within the PIA. When the dietary component using the site-specific aquatic invertebrate tissue for the Wilson's snipe was applied, risk to the soil invertebrate feeding birds was driven by Cd and Se in the Lower Eastern Drainage and Se in the Upper Eastern Drainage.

Risk to the soil invertebrate avian community at the terrestrial systems may exist from total exposure of Mo and Tl in the MA when the American robin was used for the modeling. Risk to soil invertebrate feeding birds for the aquatic and riparian systems may exist from As, Cd, U, and Zn at some of the AOIs within the MA and PIA

Carnivorous Avian Community

The great horned owl and the American kestrel were used for modeling dietary exposure risk to the carnivorous avian communities utilizing the terrestrial systems within the MA and PIA. When either species was modeled, risk from abiotic exposure to carnivorous birds was determined from Se in the MA. There was model calculated risk to carnivorous birds from total exposure to Cd, Cr, Pb, Se, and Zn in the MA and Cd in the Northeast PIA, East Haul Road, and West Haul Road. The predicted risk to the carnivorous birds was driven by estimated COPC concentrations defined by the maximum BAF values in small mammals.

Risk to the carnivorous avian community may exist within the MA from abiotic exposure to As, Cr, Pb, and Zn, and from total exposure to As, Cd, Pb, Se, and Zn. Risk to the carnivorous avian community may exist from total exposure to Cd, Cr, Pb, and Zn at the AOIs within the PIA.

Piscivorous Avian Community

The great blue heron and the bald eagle were used for modeling risk to the piscivorous avian communities utilizing the aquatic systems within the MA and PIA. (Note: a limited database on fish BAFs restricted the modeling to three COPCs - Cd, Ni, and U for the total exposure). Risk to piscivorous birds may exist from exposure to U in the MA. No risk to piscivorous birds were indicated within the PIA.

Herbivorous Avian Community

The spruce grouse and the song sparrow were used for modeling risk to the herbivorous avian communities utilizing the terrestrial systems within the MA and PIA. Abiotic exposure of Se in the MA imposes risk to the herbivorous avian community. Possible risk to herbivorous birds may exist from exposure to Cr, Pb, or Zn in the MA and from Zn at all terrestrial AOIs in the PIA.

Riparian / Wetland Ecosystems

The riparian and wetland habitats have been grouped together for the ecological characterization of this project area. The riparian and /or wetland habitats in the PIA include the banks and the low lying areas

bordering the Eastern, Central, and Western Drainages, and Blue Creek. No natural riparian/ wetland habitats were identified in the MA.

Amphibian Community

Risk to the amphibian community was based on COPCs for which toxicity reference values (TRV) were available. Measured concentrations of metals in surface water and sediments were compared to the amphibian TRVs.

Copper and Zn in surface water posed a risk to amphibians at all of the AOIs. Risk from Al and Cd may exist at all of the AOI in the MA and PIA. Chromium and Pb did not pose a risk to amphibians at any of the AOIs. Exposure to Cd and Zn in sediments posed risk to the amphibians at all of the AOIs.

Wetland Plant Community

Risk to the wetland plant community from the site-related contaminants exists within the PIA. Contaminant levels in the sediments were above the literature-based BM values for terrestrial plants. Chromium, Mn, Ni, U, and V exceeded plant BM values at all AOIs. Arsenic, Ba, Cd, Co, Se, and Zn exceeded plant BM values at some locations. Two COPCs exceeded the BM values at only one location: Cu, in Pit 3; and Tl, in Pit 4.

Wetland Invertebrates

Risk to the wetland invertebrates from site-related contaminants exists within the PIA. Contaminant levels in the sediments were above the conservative BM values for sediments. Measured concentrations of Sb, Mn, Ni, Se, and U exceeded sediment invertebrate BM values at all AOIs in the MA and PIA. Arsenic, Ba, Be, Cd, Co, and Zn exceeded sediment invertebrate BM at some locations. Two COPCs exceeded the sediment BM at only one location: Cu, in Pit 3; and Ag, in the Upper East Drainage.

Total Ionizing Radiation

Risk from TIR was evaluated following U.S. DOE (2002) guidance to aquatic biota, riparian animals, terrestrial animals and plants. Modeling for TIR within the BERA was based on central tendency concentrations providing the following assessments:

Aquatic Animal Populations

The TIR exposure to aquatic systems was calculated using the sum-of-the-fractions approach based on central tendency concentrations of the site-specific isotopes in instream sediments plus surface water. Pit 3, Pit 4, the PCP, and the Blood Pool exceeded the TIR criterion of 1 rad/day for the protection of aquatic animals. Surface water TIR exposures drive the risk with elevated TIR at each of these AOIs. Only the Outfall Pond had TIR of less than 1 rad/day.

The Central and Northeastern Drainages exceeded 1 rad/day. Surface water TIR drives the risk with elevated TIR at these two AOIs. The Western, Upper Eastern, and Lower Eastern Drainages, Upper Blue Creek, Middle Blue Creek, Lower Blue Creek, and Franklin D. Roosevelt (FDR) Lake, had TIR less than 1 rad/day, indicating no TIR risk to aquatic animals.

Riparian Animal Populations

The TIR exposure to riparian systems was calculated using the sum-of-the-fractions approach based on central tendency concentrations of the site-specific isotopes in riparian sediments plus surface water. Only the Central Drainage exceeded the TIR criteria of 0.1 rad/day for the protection of riparian animals.

Terrestrial Plant and Animal Populations

All AOIs in the MA and PIA had TIR exposures of less than 0.1 rad/day for terrestrial animals and less than 1.0 rad/day for terrestrial plants indicating no TIR risk to terrestrial plant and animal populations.

Overall Risk Summary

This ERA was conducted following Superfund guidance (EPA 1997) utilizing a systematic approach for selecting hazard and exposure parameters. The intent of this systematic process was to reduce the likelihood that risks would be underestimated, but still provide a level of understanding to allow informed management decisions. For this ERA, total exposure for estimating risk of the metals and radionuclides in the surface water, sediments and soils for each assessment endpoint was inclusive of natural background levels and was not subtracted from the total measured concentrations of the environmental media. Subsequently, naturally occurring levels of some of the metals and radionuclides were calculated to predict risk using this methodology.

The Midnite Mine site is an inactive uranium mineral mine, in a mineral-rich area and so high concentrations of metals and radionuclides were expected in all excavated areas (MA), all areas covered with waste rock (Haul Roads), and all areas within the direct influence of surface water or groundwater runoff (PIA drainages). Risk to the three ecosystems - aquatic, riparian/wetland, and terrestrial - within the MA and PIA are summarized as follows:

Aquatic Ecosystems

-High number of COPCs were identified within the aquatic habitats of the MA and the potentially impacted area (PIA).While none of the COPCs could be eliminated, those mine-related COPCs which were more pervasive, and of higher magnitude stand out (U, Al, Be, Cd, Co, Cu, Mn, Ni, Pb, Se, Ag, and Zn).
- Lacustrine habitats within the MA posed the greatest risk to aquatic communities based on the magnitude of the HQs, particularly at Pit 3, PCP, and Blood Pool. In addition, the poor water quality conditions (e.g., low pH, high sulfate, and high conductivity) would further impose significant risk to support aquatic life in these habitats.

- The utilization of the lacustrine habitats within the MA poses risk to wildlife (e.g., elk, deer, etc.) for watering and the consumption of mineral salts around the perimeter of these habitats and should be considered attractive nuisances to wildlife.

- The drainages within the PIA pose risk to the viability and function of aquatic communities based on in-place contamination of metals. In addition, the intermittent and/or low flow conditions along with the poor water quality conditions (e.g. low pH, high sulfate, and high conductivity) would further pose significant risk to support aquatic life within the drainages. The drainages continue to be a conduit for the transport of contaminants from the MA to Blue Creek.

- The onsite WTF, which operates from Spring to Fall, serves to significantly reduce the transport of contaminants from the MA to the drainages and Blue Creek. When the WTF is not operating from Fall to Winter, higher concentrations of contaminants from the MA are observed flowing to the drainages and Blue Creek.

- Blue Creek below the confluence of the Eastern Drainage is at risk from the mine drainage. There is a level of uncertainty on the causative agents imposing risk to the aquatic communities in Blue Creek including contamination of metals and TIR, as well as risk associated with reduced water quality conditions (e.g., high sulfate, high hardness, high conductivity).

- Risk to aquatic animal populations associated with TIR were found in the lacustrine habitat within the MA and in the Central and Northeastern Drainages based on exposure defined by central tendency concentrations.

Terrestrial Ecosystems

- The MA, characterized as a physically disturbed area, provides limited and poor quality habitat for wildlife. Some species of wildlife (e.g., marmot, cliff swallow) that have been reported to inhabit the MA are at risk. Wildlife that would utilize the MA for water, grazing, or salt consumption are at risk. The East and West Haul Roads which were constructed and paved with gravel and waste rock from the MA presents a significant source of contamination within the PIA

- Model calculated risk to the mammalian communities based on conservative food chain modeling was determined for herbivorous mammals, carnivorous mammals, omnivorous mammals, piscivorous mammals, and soil invertebrate feeding mammals. In general, the greatest predicted risk to the mammalian communities, particularly the herbivorous mammals, carnivorous mammals, omnivorous mammals, and soil invertebrate feeding mammals was determined within the MA. A higher number of COPCs was predicted to pose risk to these mammalian communities within the MA than at AOIs within the PIA.

For the AOIs within the PIA, a similar number of COPCs was predicted to pose risk between the Northeast and Southwest PIAs and the East and West Haul Roads to herbivorous mammals based on abiotic exposure, to the carnivorous mammals based on total exposure (i.e., dietary component plus abiotic exposure) , to omnivorous mammals based on abiotic and total exposures, and to soil invertebrate feeding mammals based on abiotic exposure. Numerous COPCs were predicted to impose risk within both the MA and PIA when

total exposure was modeled for the herbivorous mammal and soil invertebrate feeding mammal communities. For the herbivorous mammals, risk was driven by plant tissue. For the soil invertebrate feeding mammals, risk was driven by the earthworm BAF.

Risk to the piscivorous mammal community was limited to abiotic exposure of one COPC (U) within the MA and from abiotic exposure of one COPC (Mn) at Middle Blue Creek. When fish BAF values were applied to the models, a higher number of COPCs were predicted to pose risk at the AOIs within the MA than the PIA.

- Model calculated risk to the avian communities based on conservative food chain modeling was determined for insectivorous birds, omnivorous birds, soil invertebrate feeding birds, carnivorous birds, piscivorous birds, and herbivorous birds. In comparison to the mammalian communities, the avian communities had fewer number of COPCs that were predicted to pose risk within the MA and PIA. The greatest predicted risk to some of the avian communities, particularly the omnivorous birds, the soil invertebrate feeding birds, and herbivorous mammals was determined within the MA. A higher number of COPCs was predicted to pose risk to these avian communities within the MA than at AOIs within the PIA.

For omnivorous and herbivorous birds, four COPCs were predicted to pose risk within the MA and one COPC within the PIA. For both the soil invertebrate feeding birds and carnivorous birds, only one COPC (Se) was predicted to impose risk from abiotic exposure within the MA while a higher number of COPCs was predicted to pose risk from total exposure, driven either by the earthworm BAF values for the soil invertebrate feeding birds or the small mammal BAF values for the carnivorous birds. For the insectivorous avian community no risk was determined based on abiotic exposure. When total exposure was modeled for the insectivorous birds, five COPCs were predicted to be at risk within the MA and the AOIs of the PIA. Risk to the piscivorous avian community was limited to abiotic exposure of one COPC (U) at Pit 3 and the PCP within the MA. No other risk was predicted within the MA and PIA to the piscivorous birds.

- Risk to the soil microorganisms and terrestrial plant communities was the greatest within the MA having the highest number of COPCs present and the highest magnitude of HQs. Within the PIA, the East and West Haul Roads had a higher number of COPCs than the Northeast PIA and the Southwest PIA for both the ERA of the soil microorganisms and the terrestrial plant communities.

- An evaluation of risk to threatened and endangered (T&E) species was and/or can be largely accomplished indirectly within this ERA. Although determination of "injury" to T&E species is not within the jurisdiction of the EPA, it is recognized that T&E species are part of the environment to be evaluated with a BERA. Subsequently, risk to present or potential T&E species can be indirectly determined or implied within the selections of the species models and input parameters for assessment endpoints that would be appropriate to the T&E species. For example, in this ERA, the bald eagle was used as a receptor for assessing risk to piscivorous birds. Likewise, if wolves were to move back into the project area, the coyote, which was one of the receptors used for carnivorous mammal community, could be aligned with the wolf as a surrogate species for characterizing risk to carnivorous mammals.

- No risk to terrestrial plant and animal populations associated with TIR were found in the MA or PIA based on exposure defined by central tendency concentrations. There is uncertainty associated with the animal

exposure screening, because one potentially significant contributor to exposure to some wildlife that was not included in this study was the mineral salt deposits found around the perimeter of water bodies in the MA.

Riparian/Wetland Ecosystems

- The six riparian/ wetland AOIs within the PIA pose risk to the amphibian, wetland plant and invertebrate communities based on the high number of COPCs present. The drainages including Central, Upper Eastern, and Lower Eastern Drainages along with Middle Blue Creek tended to have ten or more COPCs present. Upper Blue Creek and Lower Blue Creek had the fewest COPCs present.

- Risk to riparian animal populations associated with TIR were only found in the Central Drainage based on exposure defined by central tendency concentrations.

In summation, the MA is characterized by a higher level of predicted risk to most of the assessment endpoints based on an increased number of COPCs along with HQs that tended to be at higher magnitude than within the PIA. The PIA areas adjacent to the MA and the downstream areas within the PIA tended to be characterized with lower number of COPCs and with HQs at lower magnitide than within the MA. While the MA is a physically disturbed area with limited and poor quality habitat for wildlife, there is evidence of utilization by wildlife. In addition, the lacustrine habitats within the MA appears to present attractive nuisances to wildlife. The East and West Haul Roads, constructed and paved with gravel and waste rock from the MA, present a significant source of contamination within the PIA. Further dispersion of contaminants from these haul roads to adjacent areas is anticipated from these roads.

Within the aquatic systems there is a general trend of fewer COPCs in a downstream direction from the MA to the PIA. The onsite WTF and the seep collection system serve to significantly reduce the metal loading from the MA to the drainages and Blue Creek. Higher loading of contaminants to these aquatic systems would occur in the absence of seep collection and water treatment. Blue Creek below the confluence of the Eastern Drainage is at risk from the mine drainage.

Section 10 of this document initiates the risk management process that serves to identify contaminants in surface water, sediments, and soil which contribute the most risk, identified as the risk drivers, and develops preliminary remediation goals (PRGs) for these contaminants that would provide ecological protection. Risk-based PRGs were derived based on the most sensitive assessment endpoint defined within the BERA. The risk-based PRGs were then compared to ecological derived Applicable or Relevant and Appropriate Requirements (ARARs) and to background conditions. In some cases, the risk-based PRGs are lower than ARAR's, because the risk-based PRGs are based on conservative assumptions. In cases where an ARAR based PRG or a risk based PRG would be less than background, EPA relies upon background to establish the PRG.